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A Review Paper Study on Skew Slab Bridge using ETAB Software by Finite Element Method

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ABSTRACT

- Skewed bridges are commonly used to cross roadways, waterways, or railways that are not perpendicular to the bridge at the intersection. Skewed bridges are characterized by their skew angle, defined as the angle between a line normal to the centerline of the bridge.
- In this Project work, Study the behaviour of skew slab bridges in context of lateral load distribution, skew angle effect and bending moment/ coefficient and deflection determination by ETAB Software using finite element method.

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INTRODUCTION

- Bridge is an important structure required for the transportation network. Now a day with the fast innovation in technology the conventional bridges have been replaced by the cost effective structured system.
- In this research, To Study the behaviour of skew slab bridges in context of lateral laod distribution, skew angle effect and bending moment/ coefficient and deflection determination by ETABS Software using finite element method.
- With the help of finite element method involves subdividing the actual structure into a suitable number of sub-regions that are called finite elements. The intersection between the elements is called nodal.
- In this research work we are using Etabs analysis tool which is based on Finite element method.
- After analyzing these critical loads, the results will be compared in terms of forces, deflection & moments.

SKEW BRIDGE

The easiest way to visualize Boucher's concept for the ribbed skew arch is to consider a regular arch bridge that carries the railway at right angles across the road and then to slice it vertically at regular intervals along the axis of its barrel, the planes all being parallel with the faces of the bridge, rather like the way a loaf of bread is sliced. The individual slices are then slid laterally with respect to one another in order to achieve the required oblique alignment. While the intrados of a "true" skew arch is smooth and cylindrical, the intrados of this type of "false" skew arch has a stepped appearance

LITERATURE REVIEW

1. Madhu Sharma 2017 The present paper discusses the typical skew slab behaviour emphasize on lateral live load distribution, skew angle influence and application of finite element method to determine the stress parameter. The objective of this study is to understand the the pros and cons of behaviour of skew slab bridges from the available literature.

2. Mr. sagarkumarV 2017 Bridge is very special type of structures. They are characterised by their simplicity in geometry and loading condition. The simple form of bridge is single-span beam or slab which is simply supported at its ends. Presently constructed bridge is often skew. This is due to space constrains in congested urban areas. The configuration of such a structure is the result of natural or manmade obstacles such as, complex intersection, space limitation, and mountainous terrains.
3. Anand Soni 2018 Static investigation of bridge with variety in deck profiles, i.e., PSC-I Deck, PSC-T bar, PSC-Box supports. Parametric examination will be work out utilizing different unthinkable and graphical shape which features a goal dependent on cost economy perspective as far as quality, usefulness and economy individually are the prime foundation. Here geometry was taken of "Pandit Dindayal Upadhyay Cable Stay Bridge" which is directly developing on Tapi waterway.
4. Arindham Dhar, Mithil Mujumdaar, Mandakini Chowdhary, Somnath Karmakar presented the comparison between behavioral aspects of a skew bridge by creating and analyzing straight counterparts using a 3D Bridge model in Finite Element Analysis software – ABAQUS in their research work. The results of the bridge model in ABAQUS show that with the increase in the skew angle, the support shear and mid-span moments of obtuse longitudinal girders increases while these parameters decrease with the corresponding acute angle in longitudinal girders. Most importantly, the increase un torsional moment is observed with rapid increase in obtuse skew angle in longitudinal girder. Although the changes are insignificant for inclusion in the design up to 20º skew, but at higher skew angles the increase is considerable (25% increase for 45º skew). These changes must be taken into account for correctly designing an obtuse girder. They also pointed out that with the increasing skew angle, torsional moments rise rapidly in obtuse angled girders.
5. M. Ameerutheen, Sri. Aravindan in performed their research study on the two lanes solid slab and on beam and slab arrangement (composite) on various skew angles. 1tonne/sq m of imposed load is given on each model and comparison of the results is observed to study the characteristics of skew deck and also investigational study on the skew effect if the bridge is subjected to IRC loading is completed. The analysis is done using the software STAAD-PRO to study the effect of stresses in Solid slab & Composite Bridge Deck slab. The effect of Skew angle in Composite Bridge is observed for same modesl using STAAD-PRO. The critical section in skew angle where behavior is dominant is also found out by this analysis which can be effectively used while designing skew bridge.
6. Mehrdad Bisadi in his research carried out finite element (FE) analysis on an existing railway bridge. For this purpose, the railway bridge is customized and analyzed by using finite element software, LUSAS. Analysis for Eigen value and moving load is carried out to obtain the natural frequencies and the displacement of the simulated model under the axial load of train passage. Vikash Khatri, Anshuman Khar, P. K. Singh, P. R. Maitiin their research work conducted grillage analysis method for analysis of bridges. A total of nine different grid sizes (4 divisions to 12 divisions) are made using grillage analogy and have been studied on skew angles 30°, 45° and 60° to determine the most effective grid size. In their study is observed that finite element method (FEM) and Grillage method results are not similar for every grid size. They can be different for each grid size depending on various parameters. It is also observed from the analysis that mostly seven divisions on gridding is appropriate i.e., ratio of transverse grid lines to longitudinal grid lines is 1.8-2.0. Also variation of grid sizes analysis results predicts that, variation in reaction value is same in FEM and Grillage method but variation of bending and torsion moment in FEM is lower than grillage results. So, FEM may be preferred for analysis of skew
7. Kristine Djuve 2019 The skewness of reinforced concrete bridges is defined as the angle between a line normal to the centreline of the bridge and the centreline of the support. During the analysis and design of reinforced concrete bridges, it is vital to develop specific guidelines or criteria to specify when it is acceptable to neglect the effect of the skewness. For example, the Norwegian Public Roads Administration (NPRA) provides such guidelines, based on Norwegian standards. The implementation of Eurocodes in Norway requires the updating of the previously defined guideline by NPRA. Therefore, a study using finite element software (i.e. Brigade) has been performed, to investigate the effect of skew angle on the behaviour of a single-span reinforced concrete bridge deck. In this analysis, the load cases given in Eurocodes have been used. The main parameters investigated in this study were the

span lengths and skew angles. The skew angles 0^o, 5^o, 10^0, 15^0 and 20^o were examined with 10m and 15m spans. Then, the variation of support reactions and required steel reinforcement were studied and compared with the guidelines given by NPRA.

8. bridges.Nikhil V. Deshmukh 2020 Bridges are very special type of structures. They are characterized by their simplicity in geometry and loading conditions. The reinforced concrete bridges usually carried uniformly distributed dead load, vehicular live load to its surface and transfers same to the support by flexure, shear and torsion. Newly designed bridges are often skew. This is due to space constraints in congested urban areas. It can be also needed due to geographical constraints such as mountainous terrains. However force flow in skew bridges is much more complicated than straight bridges. Therefore careful investigation and numerical analysis needs to be performed, in which a skew bridges can be modeled in several ways. Skewed slab bridges were modeled using finite-element methods using CsiBridge computer software to study their behavior under uniform and moving loads with to determine the most appropriate force response for design.

9. Kishan Gautam et. al.2020 This research is all about, for the analyses of skew bridges by the finite element method using eight nodded isoperimetric brick element (serendipity), shell elements and some different elements are also attempted, and has seen that brick elements give better results for shear. ANSYS software (version 7) has been used for the finite element analysis. The modeling which is done is applicable for any skew angle and aspect ratio of slab bridges. In this analysis, different types of I.R.C. loadings (Class AA Tracked and Class A) have been built in the modeling and also variable live load positions have been considered, to obtained maximum stresses development on the slab. The parametric study and detailed analysis has given a useful understanding for analysis of skew bridges. The main parameters considered were angle of skew, width of bridge and span length.Based on this investigation certain rules for fast examination of skew slab bridges have been suggested in the ends. The consequences of this examination are valuable for configuration engineers working in the investigation of skew slab bridges.

10. Rahna Sajeeb 2021 Bridge is exceptional type of structures which are characterized by their simplicity in geometry and loading condition. - The presence of skew in a bridge makes the analysis and design of the bridge complex. Design of bridges by using skew angle is becoming more useful in the engineering community, so there is a need for more research to study the effect of skew angle on the behavior of skewed bridges such as shear force, bending moment, torsion and other parameters. Reinforced concrete T – Beam girder of various skew angle (0°, 15°, 30°) with two lane carriageway is considered in this analysis. The analysis is done using STAAD Pro Software. The skew angle is taken at an interval of 15° starting from 0° up to a maximum of 30°.

11. 2021 In this paper, the effect of skew angle on reinforced concrete skew bridge decks is presented by using the grillage analogy. The actual deck system of the bridge is represented by an equivalent grillage of longitudinal and transverse beams. A span 26m of simply supported bridge deck is taken as the case study to obtain the values of the bending moment' s distribution versus span length for the one type of skewness and the results are compared against the moments of the right deck span of the bridge. The analysis results were based (BS5400) dead and live loads using Structural Analysis program (SAP2000). The analysis provided useful information about the variation of moments and shear forces with respect to change in skewness. It is concluded that in skew bridge deck, the bending moment is decreased, but torsional moments and shear forces are increased by increasing the skew angle. It is noticed that the maximum bending moment at skew angle 55o, by 76% in comparison with zero skew angle. On the other hand the maximum torsional moment increases for the same skew angle (55o) more than five times than with zero skew angles.

12. Pavankumar Naik 2022 Skew slab bridges are essential in mountainous areas because topographic restrictions prevented changing the alignment of the road also, crossings of roads and railroads. In simple supported bridges, the effect of skew may typically be ignored up to 15 degrees of skew, and the bridge can be constructed as a right-angled bridge. The behaviour of skew slab bridges more than 15 degrees is complicated hence the study on the behaviour of skew-bridge slab under IRC vehicle loading is carried out. About 70 different deck slab models are analyzed in STAAD Pro software with varying width from 1 to 4 lanes, and span lengths of 7.5m and 12m with for skew angles 0° to 50° in increment of 10°.The vehicle loads and

positioning of vehicles are done as per IRC-6:2017 standard specifications. The results show that the bending moment and deflection in near edge beams decreases with increase in skew angle. In farer edge beam the bending moment increase till skew of 30° and deflection increases after skew of 30°. The longitudinal bending moment decreases with increase in skew angle. Transverse bending moments are prominent at near the corners that at the centre. The torsion moments are more concerned in slabs with small width and large span. Deflection decreases at all the parts of the slab as skew increases

OBJECTIVES

To Study the behaviour of skew slab bridges in context of lateral load distribution.

CONCLUSION

- The behavior of the finite element models represented by the load-deflection curves show a good agreement with the experimental data. It is verified that the finite element analysis can accurately predict the load deformation similar to the experiment.

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